The SciBath Experiment

T1014

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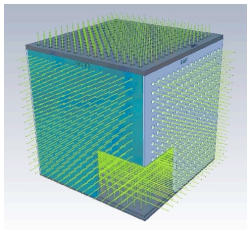
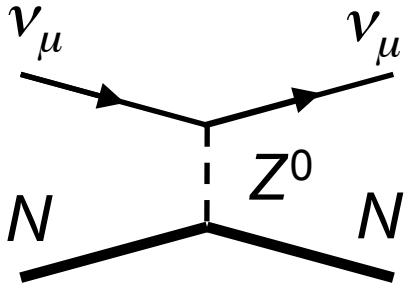
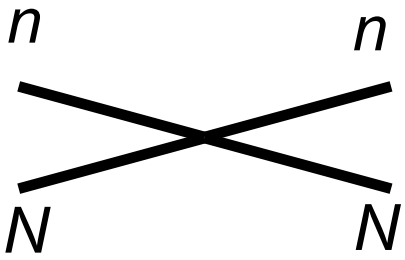
INDIANA UNIVERSITY

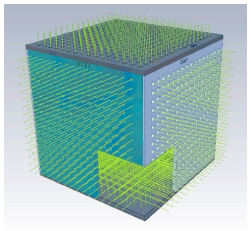


Physics Motivation

- *n* and ν event reconstruction by by charged particle tracking
- Neutral current elastic (NCel)
- Muon-induced neutrons
  - 1-100 MeV
  - Cosmogenic & beam related
  - Energy & direction spectra
- Neutrons important background for coherent NCel scattering on nuclei

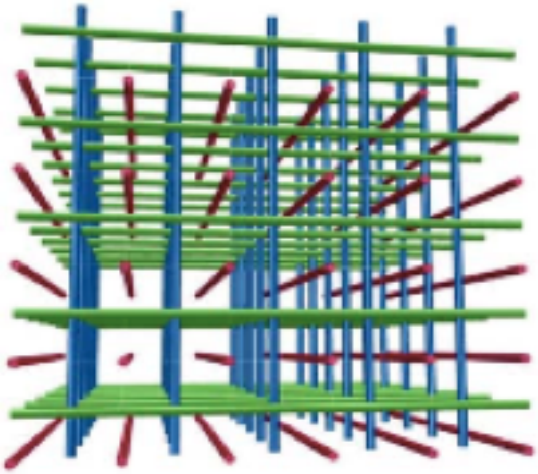


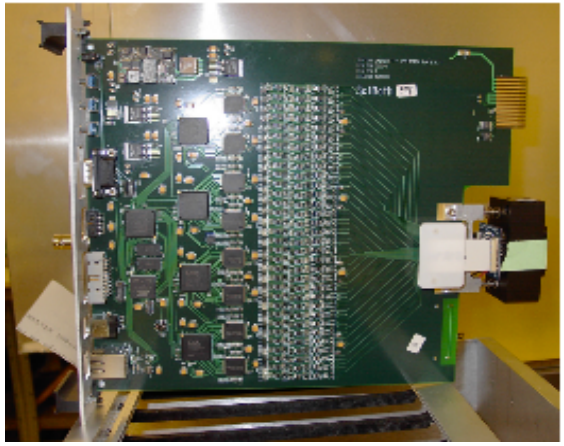


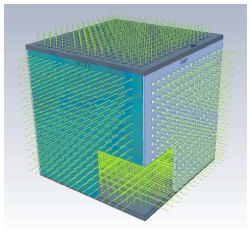


Design Concept

- Improve tracking capabilities with 3D array of light collecting fibers
- Readout high channel density system with multi-anode PMT system
- Reduce cost with custom built readout DAQ ($70 per channel with PMT)

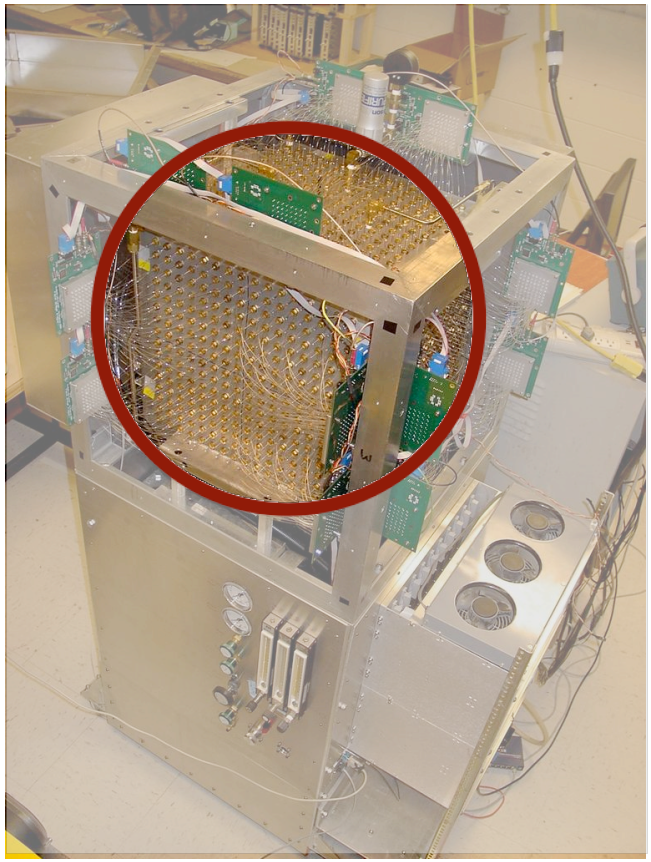


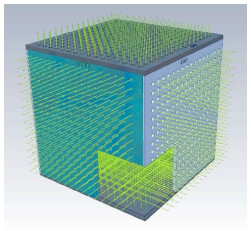




The SciBath Detector

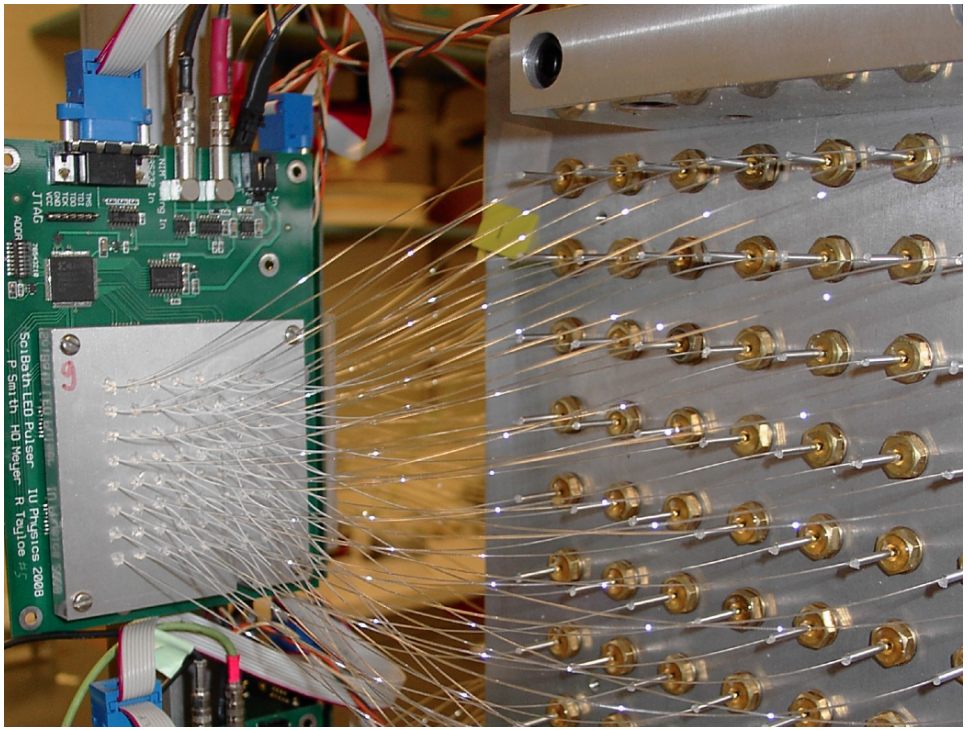
- 80 L liquid scintillator (LS)
  - 88% mineral oil
  - 11% pseudocumene
  - 1% PPO
- 768 (3-16x16) array wavelength-shifting fibers (x,y,z axes)
  - 1.5 mm diameter
  - 2.5 cm spacing
  - UV → blue

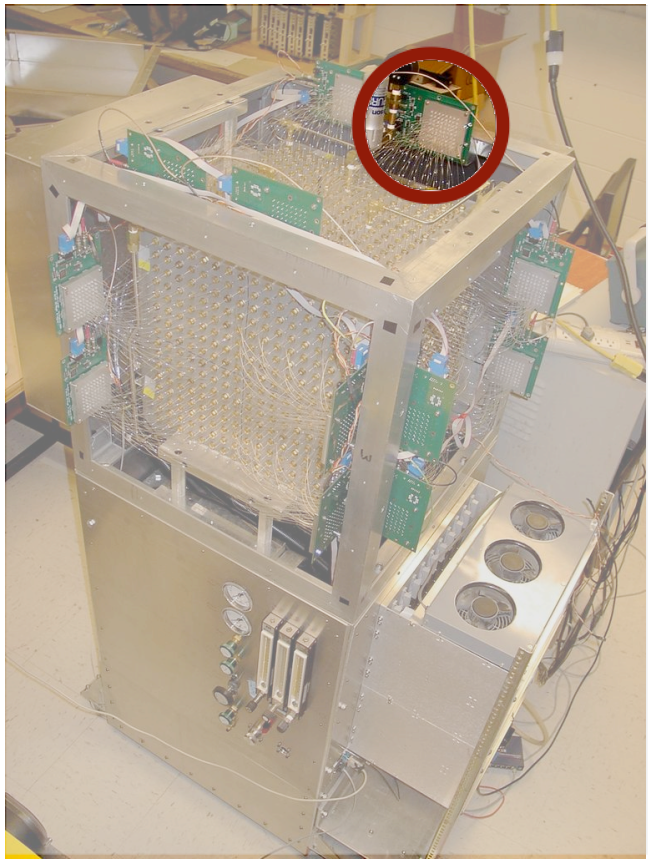


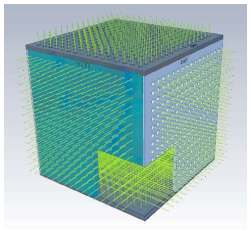


The SciBath Detector

- Pulsed LED calibration

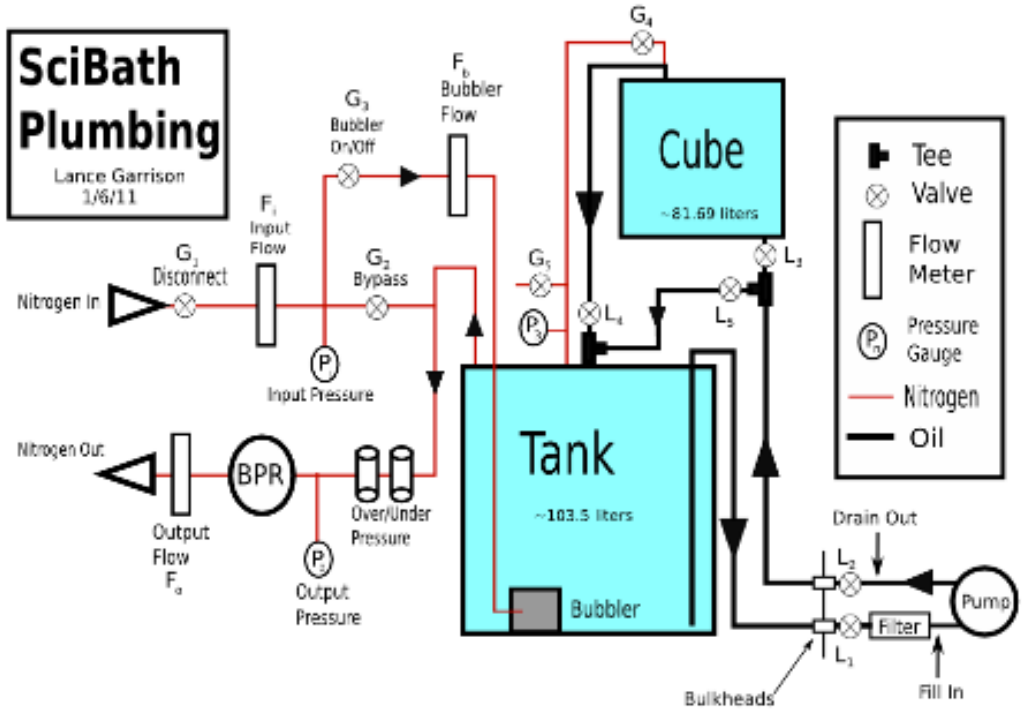


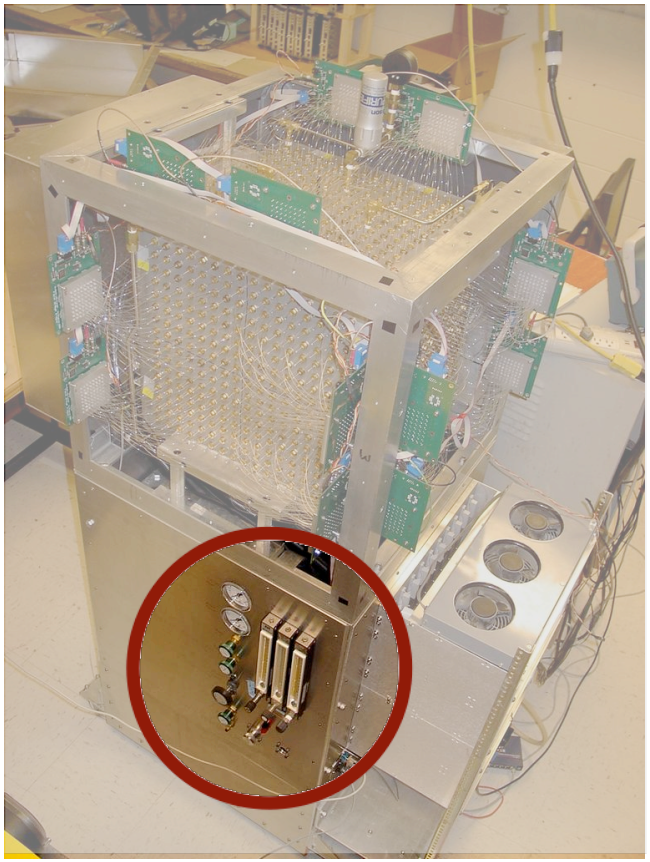


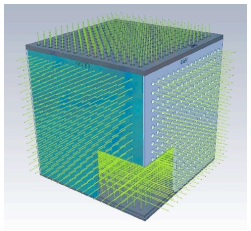


The SciBath Detector

- N_2 and LS plumbing

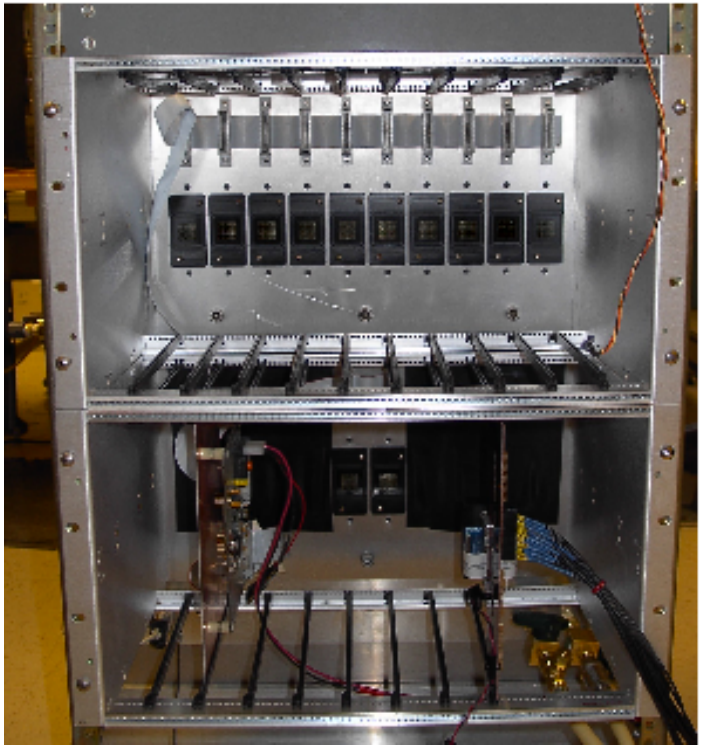


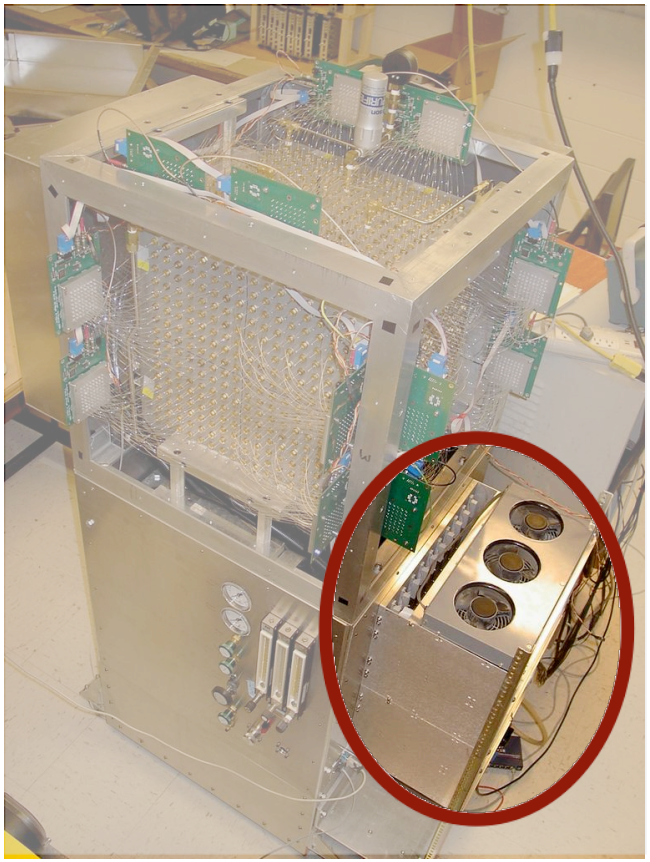


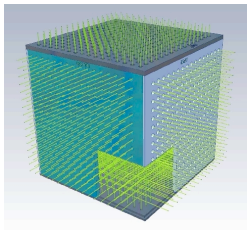


The SciBath Detector

- Electronics readout & PMTs







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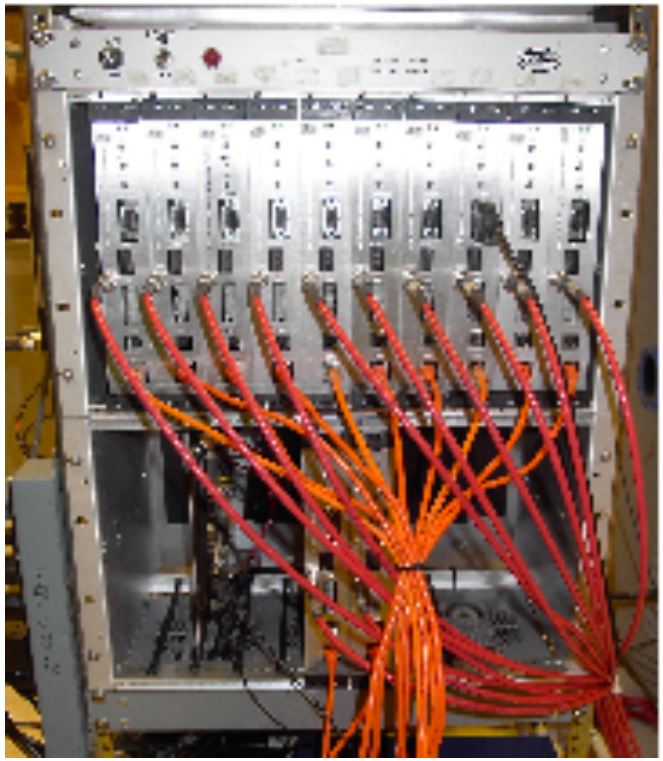
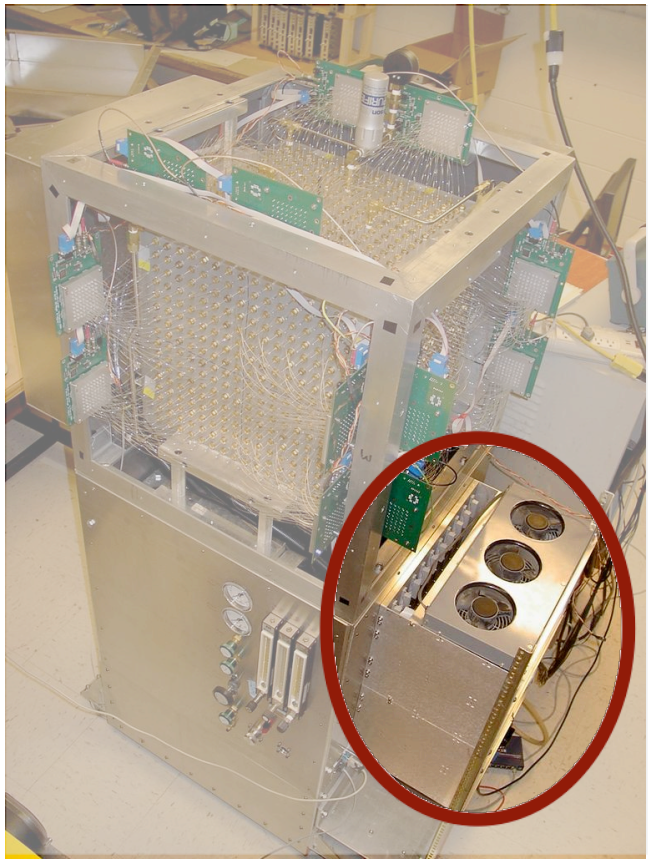
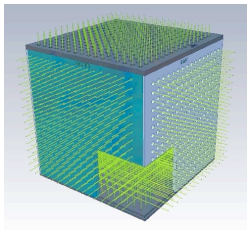


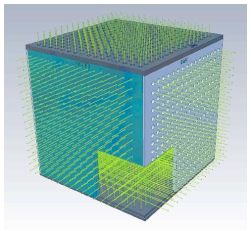




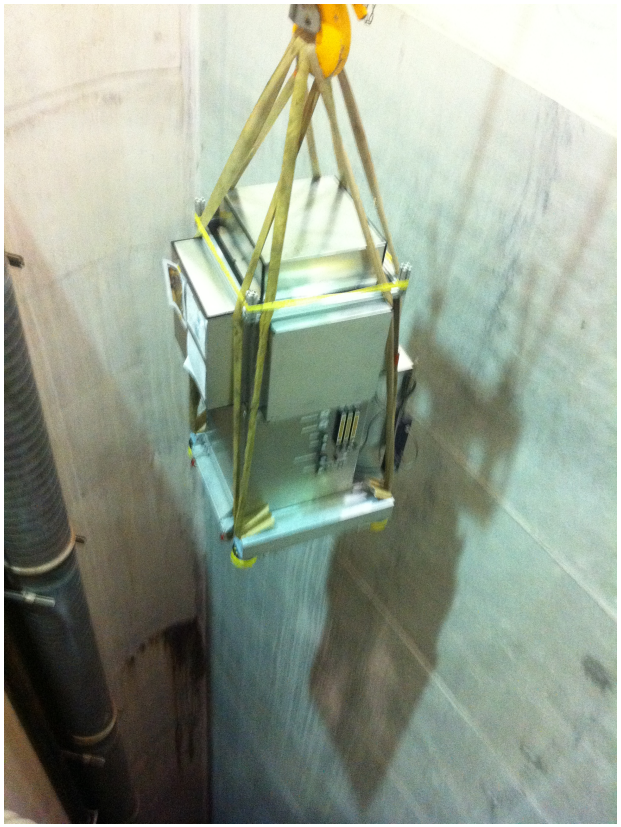
Status – MINOS Near Beam Hall

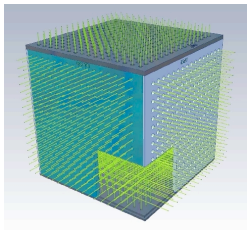
- Shipped: Oct. 3
- Safety approval: Oct. 14
- Currently monitoring 24/7
- Run completion: end of Dec.

- 5 mrad off-axis
- Situated near COUPP (downstream)



Status: Deployment





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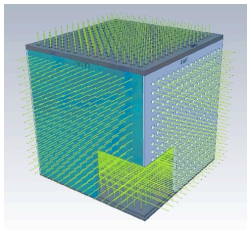
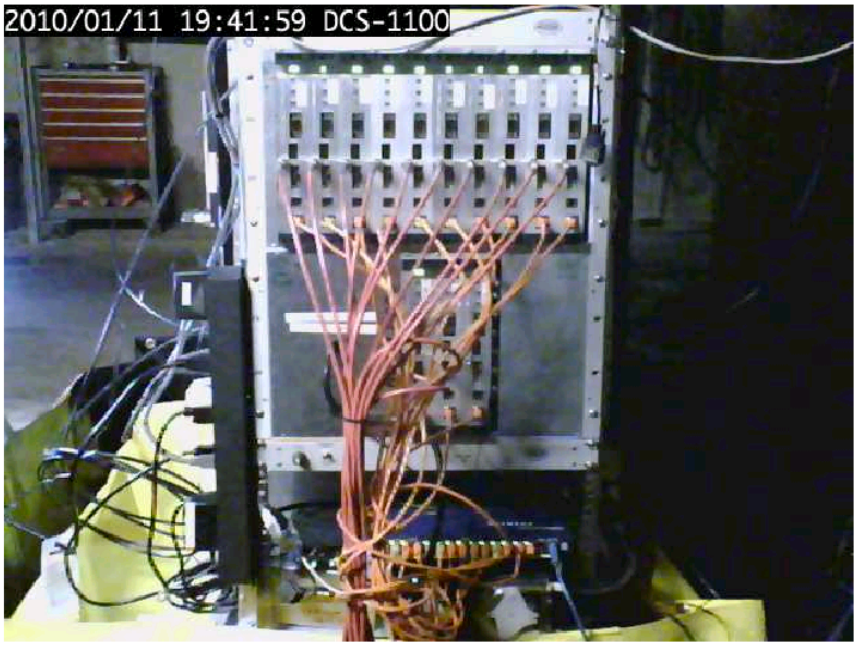
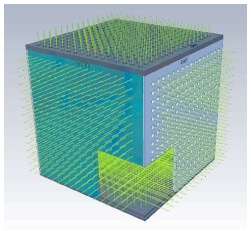


Status: Monitoring

- Dual camera monitoring (plumbing & IRMs)
- Agilent power supply web controllable
- IU personnel
  - On-shift 24/7
  - Monitoring DAQ & cameras
  - Control runs
- Expert on call 24/7
  - Within 30 minutes
  - Underground trained





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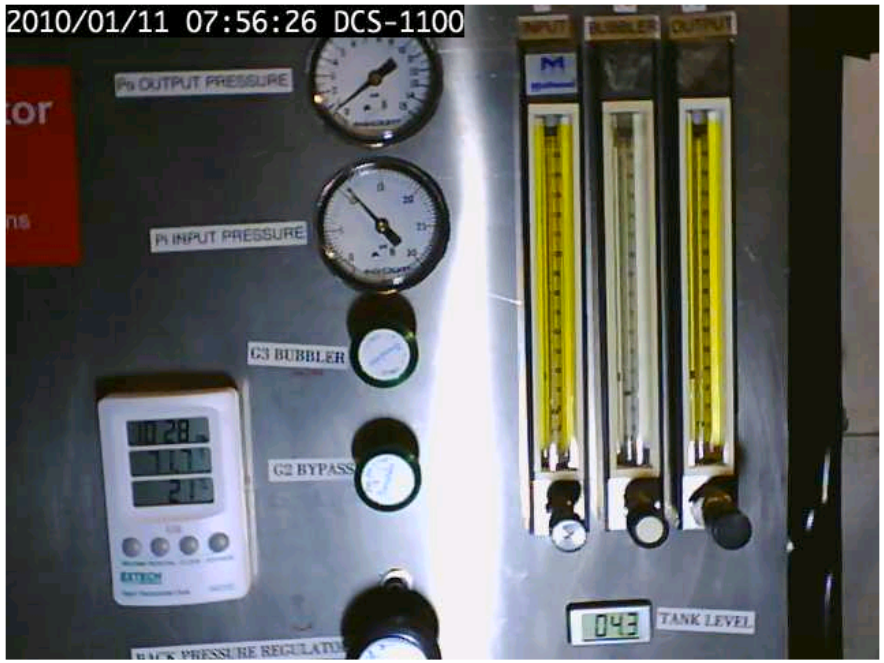
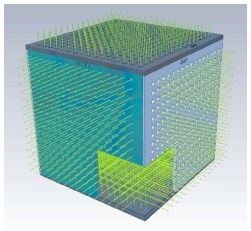
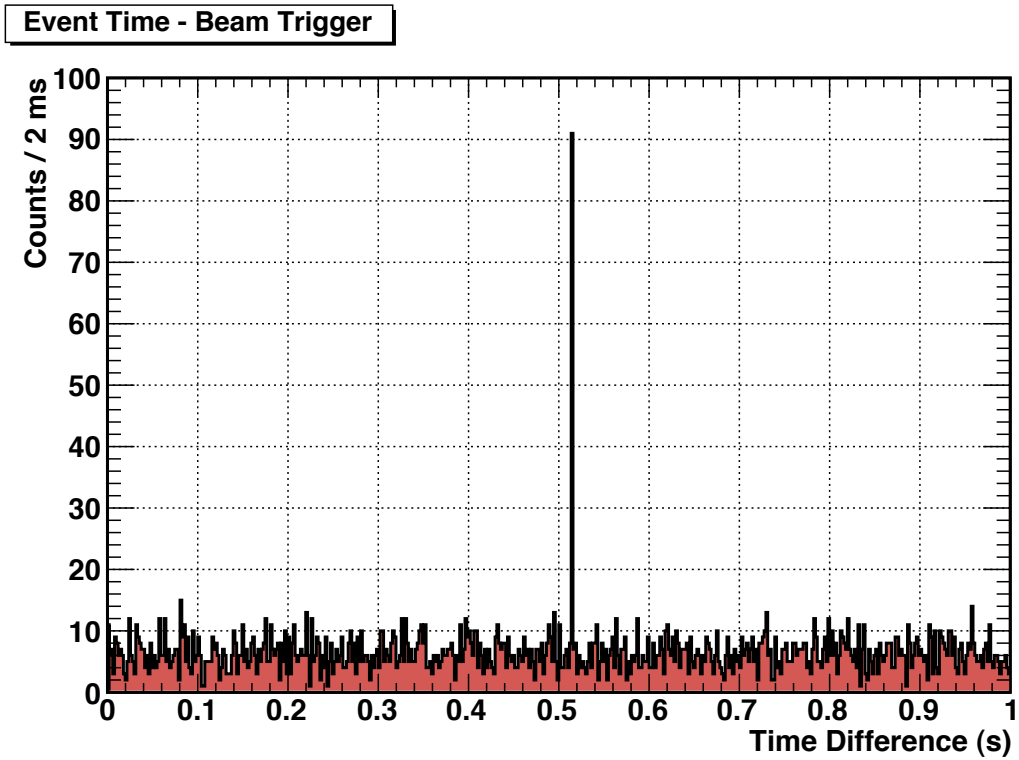
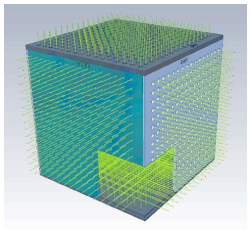




Status: Preliminary Test Results

- Beam correlated events – first light!





Contact Us

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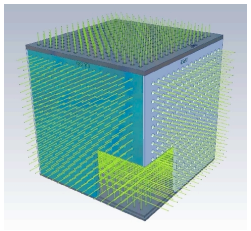
- Other Group Members on this run of SciBath
  - Graduate Student: Lori Rebenitsch
  - Student Intern: R. Tyler Thornton
- Other Contributors to SciBath detector
  - Technical / Engineering: Brandon Kunkler, Shing-Shong Shei, Gerard Vissar
  - Faculty: H.-O. Meyer
  - Former students: Melanie Novak (Gr.), Tyler Mikev (UGr.)

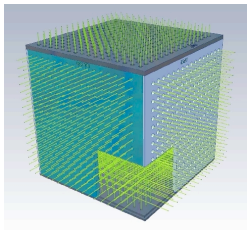


Anticipated Sensitivity (ν events)

- 2 month run time in MINOS near beam hall (through December, 2011)
- Anticipated ν event rates at 5 mrad off-axis

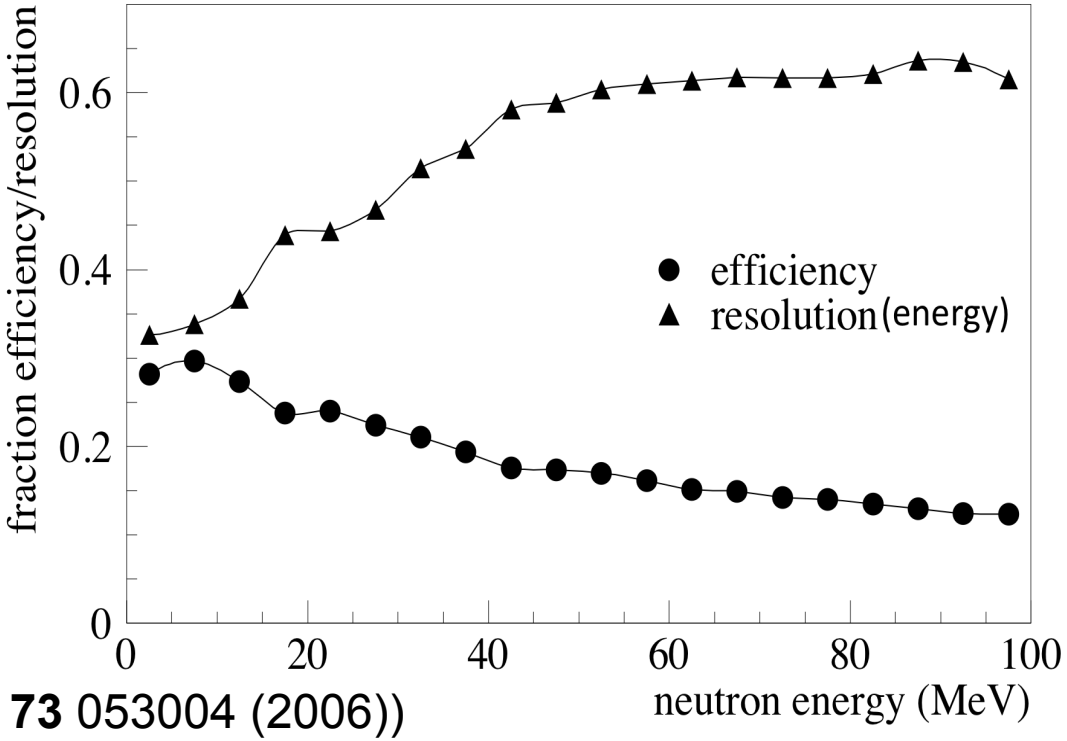
Beam Configuration	ν CC Inclusive (ν CC quasi-elastic) *
ν: Low E	**550 (100)**
ν: Med E	12000 (1400)
$\bar{\nu}$: Low E	200 (30)
$\bar{\nu}$: Med E	4000 (1300)

* Assumes an optimistic 10^{20} protons on target (~ 2 months)

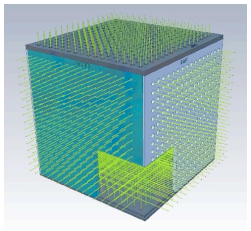


Anticipated Sensitivity (*n* events)

- Cosmogenic & beam-related, muon-induced *n*
- 100 m of rock overburden
  ⇒ 20 *n* / day
- Energy / direction spectra not well characterized*



*Mei & Hime, Phys. Rev. D **73** 053004 (2006))



Status: Preliminary Test Results

- Beam structure and response